Corporate Financing and Anticipated Credit Rating Downgrades

Abstract

Firm circumstances change but rating agencies may not make timely revisions to their ratings, increasing information asymmetry between firms and the market. We examine whether firms time the securities market before a credit rating agency publicly reveals its decision to downgrade a firm's credit rating. Using quarterly data, we show that firms adjust their financing structures before credit rating downgrades are publicly revealed. More specifically, firms on average increase their debt financing by 1.29% before the disclosure of a rating downgrade, and we find that this increase is due to the issuance of debt rather than the repurchase of equity.

JEL classification: G24, G32

Keywords: Credit rating downgrades, Information asymmetry, Capital structure

1. Introduction

In this paper we explore the hypothesis that firms exploit information asymmetry and adjust their financing activities before information about a change in their credit rating is publicly revealed. We show that firms facing downgrades exploit their presently higher ratings by increasing their debt ratio. Our research highlights the importance of credit ratings for firms' financial policies.

A change in the issuer's credit rating reflects a substantial change in the long-term credit worthiness of the firm, and therefore is an important event. This change assigns a different quantitative category, which may derive discrete costs and benefits of moving to a different rating level (Kisgen, 2006; 2009). It can result in adjustments in security prices (Hand, Holthausen, and Leftwich, 1992; Kliger and Sarig, 2000) or affect the firm's access to the external debt market (Kisgen, 2006).

Our study is motivated by evidence that rating agencies do not change ratings in a timely manner to reflect the up-to-date financial condition of a firm. The Association for Financial Professionals (AFP) conducted a survey in 2002 and reported that 'most respondents do not believe changes in their company's finances are promptly reflected in the ratings', with the delay often believed to be around six months.[1]

[1]Empirical studies have offered some explanations for the observed delay in rating changes. Altman and Rijken (2004) and Boot, Milbourn, and Schmeits (2006), among others, report that rating agencies may grant issuers time to recover before taking rating actions, and that rating agencies who pursue rating accuracy and stability to maintain

One of the functions of credit ratings is to alleviate the already existing information asymmetry between the firm and the outsiders. In this paper, we argue that the difference between the moment when the updated information about the firm's creditworthiness emerges internally and the moment when a rating agency announces a change in credit rating creates a window of increased information asymmetry between the firm and investors. This is because managers have first-hand information about the firm's financial circumstances, operating performance, growth opportunities and future prospects, while investors may not have easy access to such up-to-date information. Moreover, rating agencies typically hold meetings with the firm to gather information for analysis and then notify the firm on the rating opinions preceding the publication and dissemination of the outcome.[2]

Our ratings data come from Standard and Poor's and thus we use the figure (Figure 1), from Standard and Poor's to illustrate the information transmission mechanism in their process.[3] As shown in Figure 1, their process suggests that the rating agency and the firm share common information sets (in particular during stages 5 and 6). However, the firm might not be able to have direct communications with the rating agency about the exact timing for the release of the rating change information because the timing of the

their professional reputations do not revise credit ratings if the expected impact on credit quality of an event is considered as being temporary, uncertain or reversible.

[2]For details and a diagram on the rating process, see: http://www.standardandpoors.com/
aboutcreditratings/ RatingsManual_PrintGuide.html.

[3]https://www.spratings.com/about/about-credit-ratings/ratings-process.html

release of information is up to the judgement of the rating agency.

[Insert Figure 1 here]

Consequently, firm managers are able to foresee rating changes for the firm in the near future with greater precision than investors, based on their better knowledge of the firm's financial condition, their understandings about the agency's rating criteria and their communications with the rating agency. We term this asymmetry in information about future ratings as *the information gap*. As such, periods before rating changes increase the "information gap" between managers and investors. Intuitively, a firm may require additional financing in order to sustain operations when facing deteriorating financial conditions It is plausible that the firm raises more debt at the time of becoming more likely to be downgraded. We model and test whether firms exploit this information gap by increasing debt just before a downgrade. We argue that firms have incentives to take actions in order to take advantage of the overvalued debt when ratings are about to be downgraded.

We forecast the probability of a downgrade a quarter ahead using a logit model that incorporates the present realizations of firm characteristics and firm actions like increasing debt and/or equity, for a large sample of U.S. industrial firms from 1985 to 2010. The rating forecast model incorporates the quarter-end stock price, which reflects investors' information of the firm available to the market by the time of firm capital structure activities. In utilizing such price information, we allow the flexibility that investors are

able to gather signals about the financial health of the firm. This alleviates the possibility of a downgrade due to increased debt of a firm a quarter earlier[4]. It is not surprising that an increase in debt increases the probability of long-term rating downgrade. Most importantly, we seek to understand whether the firm possesses superior information not available to the public about a future downgrade in the firm's long-term credit rating. To this end, we use the residual of the logit model as the information gap to capture the superior information of the firm managers.

We then model the relation between the firm's financing adjustments and the estimated information gap about a rating downgrade, controlling for a set of conventional firm characteristics. This research design estimates the information gap model and the financing adjustment model together as a simultaneous system. This further mitigates the potential problem of simultaneity bias in the financing change model that can be interpreted as the possibility that the future downgrade is due to additional borrowing.

The use of quarterly data further reduces potential misinterpretation that part of our findings might be due to a credit rating agency rapidly responding to capital structure adjustments. The typical delay in credit rating adjustments of around six months reduces the probability that this change occurs in the same or in the subsequent quarter of the capital structure change. In addition, when changes in capital structure drive credit rating adjustments,

[4]Hand, et. al (1992) and Holthausen and Leftwich (1986) finds similar results after rating downgrade.

then we would expect similar effects of debt issues and stock repurchases.

Our main finding is that the information gap significantly affects firms' financing activities, particularly for speculative graded firms, at least one quarter before the rating change takes place, and also in the same quarter of the rating change. Firms that anticipate downgrades significantly increase debt financing by 1.29%, but do not adjust their equity financing.

In our sample, downgraded firms have lower liquidity than those non-downgraded firms, on average, highlighting the financial constraints of those downgraded firms, which restrict their ability to deleverage before a downgrade. In other words, firms that anticipate downgrades tend not to enjoy a luxury choice of trying to cut debt to improve credit quality. Instead, they raise more debt at the present time when debt is still relatively cheap compared to the debt costs once a downgrade is realized. This suggests a channel through which debt overvaluation occurs, which is not derived from the information content already being released to the market but is due to the late release of credit rating information.

The absence of equity changes, as shown in our Tables 1 and 4, is because net equity issues are small for downgraded firms (while much larger for non-downgraded firms). As a result, firms on average increase their debt ratio by 1.27% when they anticipate long-term credit rating downgrades in the next quarter.

We relate to studies on credit ratings and capital structure. Most notably, Kisgen (2006) finds that firms adjust their leverage to avoid credit

rating downgrades. Issuing debt when it is not yet publicly known that the firm's credit rating will deteriorate is likely to exploit inefficiencies in the market and maximizes current shareholders' value. We focus on the firms that are actually downgraded, and examine firms' actions before the information about this downgrade is released.[5]

Overall, our findings suggest that firms make financing adjustments when they have information about an upcoming credit rating downgrade that investors might not have. The important implication from our study for regulators is that requiring prompt credit rating updates will reduce the information advantage of managers and could benefit new debt holders.

The rest of the paper proceeds as follows. Section 2 develops our framework of the information gap and our hypothesis. Section 3 presents the data and sample. Sections 4 and 5 present the methodology and report the results. Finally, Section 6 concludes.

2. A model of an information gap

Credit ratings are very important in financial markets. This is not only because of the fact that ratings effectively provide an entry ticket for firms to enter into the debt market, but also that rating changes often lead to adjustments in security prices (Hand, Holthausen and Leftwich, 1992), the financing costs of firms as well as the existing credit and debt agreements of

[5] Also related is Kisgen (2009), who examines firm behavior *after* a credit rating downgrade is announced.

the firm. Kliger and Sarig (2000) show that firms' debt value increases (decreases) and equity value falls (rises) when realized ratings are better (worse) than expected ratings. In addition, policy makers have drafted financial regulations such as Sarbanes-Oxley Act with references to credit ratings, giving rise to an endorsement value of ratings. Any information pointing toward a future change in the credit rating of a firm is therefore crucial for the stakeholders of the firm and may influence the firm's financing decisions. Graham and Harvey (2001), for example, report that 57.1% of CFOs see credit ratings as important when they determine their firms' capital structure.

There is evidence that firms share and exchange information with rating agencies. Kliger and Sarig (2000) argue that instead of revealing information to the public, which may benefit competitors, firms provide rating agencies with detailed insider information during the rating process. Kisgen (2006) states that 'rating agencies may receive significant company information that is not public'. Similarly, rating agencies provide feedback to firms, as is shown in Figure 1. Thus, we postulate that firms' private communications to rating agencies may allow them to better anticipate the likelihood of future rating changes relative to the public. In our setup, a change in ratings, released as public news by ratings agencies, occurs in quarter $t + 1$.

In our framework there are two types of firms with regard to rating changes in the next quarter: (i) 'bad' firms who anticipate their ratings to be downgraded, and (ii) 'others' who anticipate their ratings either to be upgraded or to remain unchanged. We use the 'others' category as a baseline

in our test. Both types of firms, 'bad' and 'others', face possible delays in information arrival about a change in ratings. We specify a model in which a rating agency will announce at time $t+1$ a downgrade in the rating of a 'bad' firm i. Let $\mathcal{I}^D_{i,t+1}$ be the indicator of the downgrade event which takes a value of 1 when the downgrade arrives, and zero otherwise. In our framework, any market participant or investor other than the firm's managers and the rating agencies only have access to publicly available information at time t.

Define $X_{i,t}$ as the information that is publicly available about firm i including *any publicly observable action* taken by the firm that might affect the downgrade event at time t. After observing the action, the investors can infer the potential consequences of such an action on $\mathcal{I}^D_{i,t+1}$. The downgrade event also depends on the set Z_t, which is the information privately available to the firm and the rating agency at time t.

Let $I^D\left(X_{i,t}, Z_{i,t}\right)$ be the function of a downgrade for firm i at time t based on the information sets $X_{i,t}$ and $Z_{i,t}$. Let $d_t = 1$ indicate the rating agency's decision with probability π to announce the outcome from the indicator function $I^D\left(X_{i,t}, Z_{i,t}\right)$ at time $t+1$ rather than at t, else with probability $1-\pi$ for $d_t = 0$ that the rating agency decides to announce at time t. In other words, the probability of delaying the agency's assessment outcome to the public is π. Therefore, when the rating agency decides not to reveal the downgrade information until $t+1$, the public observes this downgrade event as $\mathcal{I}^D_{i,t+1}$ only until time $t+1$, but not at t.

Thus, the downgrade decision from the rating agency observed by the

public is:

$$\mathcal{I}^D_{i,t+1} = d_t I^D_t \left(X_{i,t}, Z_{i,t}\right) \tag{1}$$

where $\mathcal{I}^D_{i,t+1}$ is the observed downgrade event at t+1 on firm i, and $I^D\left(X_{i,t}, Z_{i,t}\right)$ is the assessment outcome of the downgrade function for firm i at time t.[6] Equation (1) shows the equivalence between a delay and the event of no downgrade. Thus the investor has to predict the event without full knowledge of the firm's affairs ($Z_{i,t}$), whereas the manager only needs to predict the delay by the rating agency.

For the investor without the knowledge of Z_t, her expectation at time t of a downgrade at time $t+1$ in the rating of firm i is:

$$\begin{aligned} E_t\left[\mathcal{I}^D_{t+1}\middle| X_{i,t}\right] &= E\left[d_t E\left[I^D_t\left(X_{i,t}, Z_{i,t}\right)\middle| X_{i,t}\right]\right] \\ &= \pi E\left[I^D_t\left(X_{i,t}, Z_{i,t}\right)\middle| X_{i,t}\right] \\ &\equiv \pi \widehat{I}^D_{t+1}\left(X_{i,t}\right) \end{aligned}$$

Similarly, for the manager of firm i who has the knowledge of X_t and Z_t, the expectation of a rating downgrade is:

$$E_t\left[\mathcal{I}^D_{t+1}\middle| X_{i,t}, Z_{i,t}\right] = \pi I^D\left(X_{i,t}, Z_{i,t}\right)$$

[6] According to the model, when there is no delay in the rating agency's rating announcement, i.e., $\pi = 0$ such that with 100% probability $d_t = 0$, then at time $t+1$ the indicator $\mathcal{I}^U_{i,t+1}$ of the upgrade event takes a value of zero. The observed rating change therefore occurs in the same period as soon as the indicator function gives its assessment outcome.

The information gap between the firm manager and the investor for a rating downgrade for firm i is therefore:

$$E_t\left[\mathcal{I}^D_{t+1}\middle|\, X_t, Z_t\right] - E_t\left[\mathcal{I}^D_{t+1}\middle|\, X_{i,t}\right] = \pi\left[I^D\left(X_t, Z_t\right) - \widehat{I}^D_{t+1}\left(X_{i,t}\right)\right]$$
$$\equiv \pi G^D_{i,t+1}.$$

2.1. An empirical model of an information gap

In order to capture the expectation in rating changes of the 'outsiders' who use public information, we use a logit model to capture the likelihood of a downgrade (as in I^D_t) in the next period based on the information available in the current period. Specifically, we construct indicator $LTD^D_{i,t+1}$ for a downgrade, on the long-term debt rating for firm i in quarter $t+1$ as:

$$LTD^D_{i,t+1} = \begin{cases} 1, & SPLT_{i,t+1} < SPLT_{i,t} \\ 0, & otherwise \end{cases} \tag{2}$$

where $SPLT_{i,t}$ and $SPLT_{i,t+1}$ are, respectively, the Compustat data items for the S&P domestic long-term issuer credit rating for firm i at quarters t and $t+1$. S&P long term credit rating reflects Standard & Poor's view of the obligor's capacity and willingness to meet its long-term financial commitments.

It is important to note that there is a distinct difference between our downgrade indicators and those of Kisgen (2006). Kisgen (2006) defines firms

being rated with a '+' at the beginning of the year as an upgrade indicator and firms being rated with a '-' as a downgrade indicator. An alternative indicator may be the so called CreditWatch announced by rating agencies, which is a qualitative opinion about the firm's prospect. However, according to Standard and Poor's, "CreditWatch is not intended to include all ratings under review, and rating changes may occur without the ratings having first appeared on CreditWatch".[7]

In our study, we look at the actual change in ratings from quarter t to $t+1$. We consider this a realistic classification of the direction of rating changes for our purposes.[8]

Thus the downgrade decision from the rating agency is based on decision model:

$$LTD^D_{i,t+1} = \mathcal{I}^D_{i,t+1} = d_t I^D(X_{i,t}, Z_{i,t}) \tag{3}$$

where $X_{i,t}$ is a vector of observable state variables and firm actions that captures the changes to capital structure of the firm, and $Z_{i,t}$ is a vector of unobserved decision variables.

Since only $X_{i,t}$ is observed by the public, the logit model is estimated by the public as:

$$E(\, LTD^D_{i,t+1} \big|\, X_{i,t}) = \frac{exp(X'_{i,t}\beta)}{1 + exp(X'_{i,t}\beta)}. \tag{4}$$

Specifically, we regress the downgrade outcome $LTD^D_{i,t+1}$ on the state

[7] See, page 8 on http://www.standardandpoors.com/spf/general/RatingsDirect_Commentary_979212_06_22_2

[8] For example, when the US and UK government bond ratings were moved from AAA to AA+, the 'plus' status does not mean that they are now more likely to be upgraded in the near future. Instead, they were considered as a downgrade by the market.

variables: $Leverage_{i,t}$, $Profit_{i,t}$, $Size_{i,t}$, $Price_{i,t}$, and $Liquidity_{i,t}$ (see also Ederington and Yawitz, 1986), controlling for both the industry and quarter fixed effects. It is plausible that when firms increase their leverage ($\triangle det_{i,t}$) or decrease their equity ($\triangle eqt_{i,t}$) through share repurchase, the likelihood of a downgrade increases. The changes in capital structure $\triangle det_{i,t}$, $\triangle eqt_{i,t}$ in equation 3 are publicly observable. Thus, our framework accommodates the ability of outside investors of observing $\triangle det_{i,t}$, $\triangle eqt_{i,t}$, and hence being able to predict the possibility of a downgrade in the next period.

Having estimated equation 3, we obtain the forecasted probability (also see the Appendix) of rating downgrades $\widehat{LTD}^{D}_{i,t+1}$ for firm i in quarter $t+1$ as defined below:

$$\widehat{LTD}^{D}_{i,t+1} = Prob\left(LTD^{D}{}_{i,t+1} = 1 \middle| X_{i,t}\right) \tag{5}$$

We use the rare events small sample bias correction method of King and Zeng (2001) on our model, as the large majority of firm-quarters are not associated with downgrades.

Next, we define the gap between the realized rating change at time $t+1$ and the outsiders' expectation of a rating change based on public information for an upgrade and a downgrade, respectively, as:

$$GLTD^{D}_{i,t+1} = LTD^{D}_{i,t+1} - \widehat{LTD}^{D}_{i,t+1} \tag{6}$$

which is a function of the unobserved variables $Z_{i,t}$ (see Cramer, 2005).

In our framework, the managers have superior information relative to the public, and the gap defined above captures the content of the superior information reflected in $Z_{i,t}$, which is instrumented by the information gap. We examine whether this residual private information has value and is related to changes in capital structure.

2.2. Foreseeable downgrades and firm actions

Consider a firm that faces negative future prospects the current rating of the firm may over evaluate its credit quality. A rating downgrade coming late may thus grant opportunities for the firm to hold back the unfavorable information from the outsiders, and allow a time window for the firm to conduct financing at relatively lower costs than the would-be cost level had the unfavorable information being revealed without delay.

Formally, define the market value of the firm at time t as:

$$A_{it} = E_{it} + D_{it}$$

where E_{it} and D_{it} are, respectively, the market values of equity and debt of firm i at time t. A rating downgrade will lead to a reduction of the firm value which will lower the market value of the firm to $A^D_{i,t+1}$ at time $t+1$:

$$\mathcal{A}^D_{i,t+1} \equiv A_{it} + I^D\left(X_{it}, Z_{it}\right) \Delta A_{it+1} < A_{it},$$

Hence, the expected market value of the firm by the manager, having taken into account of the probability π of delaying rating changes, is:

$$E_t\left[\mathcal{A}^D_{i,t+1}\middle|\, X_{it}, Z_{it}\right] = A_{it} + \pi I^D\left(X_{it}, Z_{it}\right)\Delta A_{it+1}$$

The expected market value of firm i by the uninformed public investor is:

$$E_t\left[\mathcal{A}^D_{i,t+1}\middle|\, X_{it}\right] \equiv A_{it} + \pi \widehat{I}^D_{t+1}\left(X_{it}\right)\Delta A_{it+1}.$$

Therefore the difference in the expected market value of the firm, $\mathcal{V}^D_i$, from the information gap between the firm and the public is:

$$\begin{aligned} E_t\left[\mathcal{V}^D_{i,t+1}\middle|\, X_{it}, Z_{it}\right] &= E_t\left[\mathcal{A}^D_{i,t+1}\middle|\, X_{it}, Z_{it}\right] - E_t\left[\mathcal{A}^D_{i,t+1}\middle|\, X_{it}\right] \\ &= \pi\left(I^D\left(X_{it}, Z_{it}\right) - \widehat{I}^D_{t+1}\left(X_{it}\right)\right)\Delta A_{i,t+1} < 0 \end{aligned}$$

It is clear therefore that if a firm faces a downgrade, there is overpricing in the current market value of the firm at time t because of the increased likelihood of a debt default. In other words, before a downgrade a firm enjoys potential discrete benefit in firm value from the presently higher rating, which is consistent with the CR-CS theory (see Figure 1, Kisgen 2006). To re-iterate, our focuses are that managers are concerned about the anticipated future rating changes, and that managers understand the potential discrete benefit in firm value.

Effectively, the firm is in a position to explore mis-pricing by increasing

debt or equity at time t.[9] When a firm faces a downgrade, it's decision is whether to raise equity or debt in order to exploit overpricing. These actions, however, have costs, and therefore, firms must balance the associated costs and benefits of debt and equity to decide the financing choice.

We argue that 'bad' firms will prefer debt to equity since increasing equity will have limited benefits, but immediate costs. The choice of increasing equity at time t may cause significant drops in the stock price on the announcement of an equity issuance (Asquith and Mullins, 1986). This is because investors are aware of the problem of information asymmetry, and believe that the firm's stock is overvalued when the firm undertakes seasoned equity offerings (Fama and French, 2005).

By using debt financing before a downgrade, 'bad' firms face a risk of sending the rating further down the line. On the other hand, 'bad' firms can take advantage of the relatively cheaper debt before the downgrade is realized. The cost of debt capital reflects the perceived creditworthiness of the firm, and 'bad' firms may prefer to get the benefits of leverage before the downgrade. Berger, Espinosa-Vega, Frame and Miller (2005) also suggest that firms with unfavorable private information are willing to pay the costs on long-term debt. From the above analysis we arrive at our hypothesis:

Hypothesis 1 *: 'Bad' firms prefer to increase debt before a credit rating downgrade.*

[9] In general, debt financing benefits firms by lowering the weighted average cost of capital. Korteweg (2010) provides evidence for the net benefits to leverage.

Specifically, the hypothesis states that: The relation between the change in debt $\triangle det_{i,t}$ *and the information gap,* $\pi G^D_{i,t+1}$*, for a firm who anticipates a downgrade is positive, i.e.,* $\triangle det_{i,t} = g\left(\pi G^D_{i,t+1}\right)$*,* $g' > 0$*. Notice that a test of this hypothesis is a joint test of* $\pi > 0$ and $g' > 0$.

If the results indicate that $\triangle det_{i,t}$ is not related to $G^D_{i,t+1}$, it will be a result of either $\pi = 0$, which suggests that the firm does not have insider information, and/or $(g' = 0)$, which suggests that the firm does not take action according to our hypothesis.

3. Data and sample

We collect quarterly data of firm financial and monthly Standard & Poor (S&P) ratings data from Compustat, covering more than 30,000 active and inactive publicly listed firms in the U.S. The sample covers all firms with quarterly financial data and at least one rating record during the sample period from Q1 1985, when the ratings data begin, until Q4 2010. We exclude firm-quarter observations with negative equity, i.e., leverage greater than one.[10]

We further exclude utility companies (SIC 4900-4999) and financial companies (SIC 6000-6999). Myers (2001) points out that these companies have a narrow menu of financing choices and cannot adjust their capital structures at relatively low costs. In addition, regulations relating to the disclosure policies of financial firms are usually stricter than those for non-financial firms.

[10] See the appendix for details on the variables we use in the analysis.

3.1. Summary statistics

We classify a firm-quarter as a 'downgrade' when the firm gets downgraded in the next quarter. Panels A and B of Table 1 show, respectively, summary statistics for the no-downgrade sample, which contains 120,884 firm-quarter observations, and the downgrade sample, which contains 1,376 firm-quarter observations.[11] The downgraded firms, compared to firms whose ratings are not downgraded, have much higher leverage ratios (50.6% versus 23.5%), lower liquidity (7.5% versus 19.2%), lower *Growth* (Market-to-Book ratio) (1.09 versus 1.85), and hold more fixed assets (37.8% versus 26.5%). All of these point to deteriorating financial conditions of the downgraded firms.

These results are consistent with the findings in the capital structure literature that companies with relatively safe and tangible assets tend to borrow more than companies with risky and intangible assets since intangible assets are more likely to encounter losses under financial distress (see, Myers 1984, and Frank and Goyal 2003). The downgraded firms also have higher average *Size* (the log of sales), which is consistent with the notion that large companies tend to borrow more than small firms (see, Myers, 2001, and Frank and Goyal, 2003). Interestingly, in terms of financing activities, the downgraded firms, on average, raise more debt (normalized by total assets) than those firms whose ratings are not downgraded (3.7% versus 0.6%).

[11] Applying further restrictions on selecting downgraded firms such as those who are downgraded more than once or downgraded by more than one notch may result in very sample size, which undermines robust statistical analysis.

[Insert Table 1 here]

4. Estimation results of the information gap model

As outsiders do not possess insider information Z_{it}, they estimate the logit model for the probability of a credit rating downgrade as in equation 4 for $\widehat{LTD}^{D}_{i,t+1}$. From the view point of insiders (either the firm manager or the rating agency), however, the outsiders' estimation suffers from an omitted variable (Z_{it}) bias. Thus, the statistical significance of the coefficient estimates are biased from the view point of those who possess insider information. Table 2 reports the results of estimating credit rating downgrades in a logit model. Firms with high leverage levels tend to be more likely to get credit rating downgrades, while profitable firms are less likely to be downgraded. For the firm action variables, an increase in debt to total assets i.e. $\triangle det_{i,t}$, increases the probability of long-term rating downgrades. On the other hand, an increase in equity to total assets, i.e. $\triangle eqt_{i,t}$, decreases the probability of long-term rating downgrades, albeit statistically insignificant.

The quarter-end stock price, which reflects investors' information of the firm available to the market by the time of firm capital structure activities. In utilizing such price information, we allow the flexibility that investors are able to gather signal about the financial health of the firm. The result shows an intuitive pattern that higher stock price is associated with a lower probability of a credit rating downgrade.

[Insert Table 2 here]

Next, we analyze the information gap between the insiders and outsiders. The insiders know with certainty about the future rating changes, and hence do not need to estimate the logit model as the outsiders do. Table 3 shows that, for those firms whose ratings are not downgraded, outsiders who use the logit model are nearly 99% correct in predicting no downgrades. More interestingly, for those firms whose ratings are actually downgraded, outsiders are only 4.1% correct in predicting downgrades, while nearly 96% will fail to predict downgrades. These results suggest a potentially large information gap.

[Insert Table 3 here]

4.1. Modeling of debt and equity changes due to an information gap

To investigate firm behavior due to the information gap, we run regressions as in equations 7, 8 and 9 of the change in debt, equity and net debt, normalized by total assets, on the information gaps in rating changes and firm-level control variables. The rating changes take place in quarter $t+1$. We test the effects one quarter before (in quarter t) and in the same quarter of rating changes (at time $t+1$):

$$\triangle det_{i,t+\tau} = \alpha_0 + \alpha_1 GLTD^D_{i,t+1} + \alpha_{\mathbf{c}} X_{i,t+\tau-1} + \varepsilon_{i,t+\tau}, \quad (7)$$

$$\triangle eqt_{i,t+\tau} = \beta_0 + \beta_1 GLTD^D_{i,t+1} + \beta\gamma_{\mathbf{c}} X_{i,t+\tau-1} + \varepsilon_{i,t+\tau} \quad (8)$$

$$\triangle net_{i,t+\tau} = \gamma_0 + \gamma_1 GLTD^D_{i,t+1} + \gamma_{\mathbf{c}} X_{i,t+\tau-1} + \varepsilon_{i,t+\tau} \quad (9)$$

where $\tau = (0, 1)$, $\tau = 0$ for one quarter before rating changes, and $\tau = 1$ for the same quarter of rating changes. The coefficients α_1, β_1 and γ_1 capture, respectively, the effects of adjustments in debt, equity and net debt (debt minus equity) to the information gap pertaining to a long-term credit rating downgrade in quarter $t + 1$. The vector of $X_{i,t+\tau-1}$ represents the control variables. We control for both the industry and quarter fixed effects, and also obtain clustered standard errors using the approach of Peterson (2009).[12] We obtain the variables $GLTD^D_{i,t+1}$ from equation (6), having estimated $LTD^D_{i,t+1}$ using equation (3) as reported earlier. The effect we are estimating is the statistical and economic significance of the information gap $GLTD^D_{i,t+1}$ on the left-hand-side variables between the downgraded and non-downgraded firms.

Our *Hypothesis* states that 'bad' firms prefer to take advantage of the overvalued debt before a rating downgrade. Hence, it predicts a significantly positive α_1 in equation (7), an insignificant β in equation (8), and a signifi-

[12] We thank John McInnis for his SAS code of the clustered standard errors adjustment, which is available at: http://www.bhwang.com/a_research/z_codes/Clustering%20%28Code%29.txt

cantly positive γ_1 in equation (9) when $\tau = 0$.

We now take a close scrutiny on the use of long-term and short-term financing to understand the ways firms apply when they anticipate rating changes. To this end, we run the following regressions (eqs. 10 and 11) using the dependent variables defined in Section 3.: the ratio of the current period short-term debt change to previous period total assets, $\Delta Sdet_{i,t}$, and the ratio of the current period long-term debt change to previous period total assets, $\Delta Ldet_{i,t}$.

$$\triangle Sdet_{i,t+\tau} = \alpha_0^S + \alpha_1^S GLTD_{i,t+1}^U + \alpha_2^S GLTD_{i,t+1}^D + \alpha_{\mathbf{c}}^{\mathbf{S}} X_{i,t+\tau-1} + \varepsilon_{i,t+\tau} \quad (10)$$

$$\triangle Ldet_{i,t+\tau} = \alpha_0^L + \alpha_1^L GLTD_{i,t+1}^U + \alpha_2^L GLTD_{i,t+1}^D + \alpha_{\mathbf{c}}^{\mathbf{L}} X_{i,t+\tau-1} + \varepsilon_{i,t+\tau} \quad (11)$$

where $\tau = (0, 1)$.

5. Estimation results of debt and equity changes

5.1. One quarter before rating changes

Table 4 reports the estimation results for debt financing one quarter before changes in long-term credit ratings. In line with our *Hypothesis* the information gap for a long-term credit rating downgrade $GLTD_{i,t+1}^D$ has a positive coefficient of 1.29% ($t = 5.33$) to changes in debt. Interestingly, equity financing $\Delta eqt_{i,t}$, in the second column, is not significantly associated with the rating downgrade variable ($t = 0.02$). The increase in net debt,

in the third column, is 1.27% ($t = 2.38$). This evidence suggests that 'bad' firms embark on more net debt before the anticipated rating downgrade is materialized. Notice that when our results would be driven by a reversed causality argument, then we would expect similar effects of debt issues and stock repurchases on credit rating adjustments, and this is not what we find.

[Insert Table 4 here]

The coefficient estimates for the control variables in Table 4 are consistent with the findings in the literature in both the sign and statistical significance. The negative coefficient of leverage (-0.0134, t = -11.04) indicates that *Leverage* in the previous quarter has a significantly negative effect on debt change in the current quarter, i.e., firms with higher leverage ratios raise less debt. The negative coefficient of *Liquidity* (-0.0175, t = -11.96) indicates that firm with cash and short-term investment opportunities choose to finance less by debt. *Profit* is negatively related to equity change (-0.154, t = -66.95). These results are consistent with the notion that profitable firms have more internal financing resources available (Myers, 2001).

Consistent with the finding of Dittmar and Thakor (2007) that firms with retained earnings tend to finance projects internally, *Retained earnings* shows negative and statistically significant coefficients for the changes in debt and equity. Firms holding valuable *growth* opportunities tend to increase equity financing (0.0014, $t = 25.2$) but not debt financing (coefficient value is virtually zero) (see also Myers 1984, and Rajan and Zingales, 1995). *Tangibility*

is positively related to both debt and equity changes. *NDTS* is negatively related to both debt change (-0.0264, t = -3.25) (see also, DeAngelo and Masulis 1980, and Bradley, Jarrell, and Kim 1984), and equity change (-0.0623, t = -3.88).

In terms of the long-term and short-term debt mix, as reported in columns 4 and 5 of Table 4, the loading of the information gap variable $GLTD^{D}_{i,t+1}$ is positive and statistically significant when explaining changes in long term debt, while short-term debt does not respond to the information gap. This indicates that 'bad' firms mainly raise long-term debt before a downgrade of their long-term credit rating.

Overall, our findings suggest that firms that will be downgraded tend to take advantage of their currently higher credit rating. In line with Berger, Espinosa-Vega, Frame and Miller (2005), firms with unfavorable private information are willing to pay the costs on long-term debt.

5.2. The same quarter as rating changes

Because firms could potentially raise debt one day before an announced downgrade, we also examine the relation between downgrades and capital structure changes in the same quarter. Table 5 reports firms' financing behavior in the same quarter of rating changes, and confirms our earlier findings that 'bad' firms significantly increase debt. 'Bad' firms also do not significantly increase equity in the same quarter of the downgrade, which is similar to the insignificant equity increase in the quarter before a downgrade, as reported in Table

4. Note though that the capital structure change in Table 5 could also occur right after a downgrade (while still in the same quarter) and issuing equity could be attempts to increase the firm's creditworthiness (see also Kisgen, 2009).

[Insert Table 5 here]

We further find that, in the same quarter when the news of a downgrade in the long-term credit rating is announced, the increase of total debt of 'bad' firms rests on long-term debt increases 3.76% ($t = 15.47$). Again, this finding suggests that 'bad' firms take advantage of the relatively cheaper long-term debt before downgrades.

5.3. Investment-grade and speculative-grade firms

We further find that firms' actions with respect to the anticipated rating changes differ across rating categories. In particular, speculative-grade firms appear to be more responsive in adjusting debt than investment-grade firms. Specifically, we estimate equations 7, 8 and 9 for two sub-samples: firms with S&P investment-grades (BBB and above) and firms with S&P speculative-grades (below BBB) according to the S&P domestic long-term issuer credit rating at time $t + 1$ (the quarter when the rating change is announced).

Columns 6 and 7 of Table 4 and 5 show that before a downgrade 'bad' firms in the speculative-grade spectrum increase debt to utilize the information gap. The effect is weaker for firms with investment-grade debt ratings.

These findings suggest that speculative-grade firms are keener to take advantage of the information gap than investment-grade firms, which is in line with changes in credit ratings being more important for speculative-grade firms, for example because lower ratings reduce the number of bond portfolio managers that are allowed to invest in the bonds (Grinblatt and Titman, 2002). Intuitively, the information gap between the lower-rated firms and outsiders is greater than that of the higher-rated firms, as for instance, fewer analysts tend to follow lower-rated firms (Chung, 2000).

6. Conclusions

We investigate the impact of information asymmetry between firms and investors, created by the delay in the arrival of credit rating changes, upon firms' financing changes. Relative to public investors, firm managers and rating agencies possess more precise and up-to-date knowledge and predictions on the firm's next-period ratings. This paper asks whether the superior information of the firms allows them to adjust their financing activities before the news of rating changes is publicly disseminated.

We construct a measure of the information gap between firms and investors concerning rating downgrades in the next quarter. We present a model in which outsiders predict firm rating changes based on the firm's actions and all other publicly available information. Our framework therefore explicitly accommodates the ability of outsiders to infer the change in the

firm ratings by observing the firm's actions on capital structure changes. The information gap is thus defined as the difference between the actual and the forecasted rating changes. We then model the relation between the firm's financing adjustments before a downgrade and our measure of the information gap, controlling for a set of conventional firm variables.

Our results indicate that firms take advantage of the information asymmetry and change their financing accordingly. We find that firms raise extra debt in the quarter before a downgrade on the long-term credit rating, consistent with our hypothesis that firms take advantage of the relatively cheaper debt before downgrades. Further, the downgraded firms do not decrease equity before downgrades, which is evidence against a reversed causality argument.

The evidence suggests that the information gap on credit ratings between firms and the market exists, and also that firms take advantage of the information gap by changing their capital structures. Our findings have important implications for policy makers in that tightening the requirements for rating agencies to provide timely updates on their rating outputs will reduce asymmetric information and will be beneficial for public investors and other stakeholders.

References

Asquith, P., & Mullins, D. W. (1986). Equity issues and offering dilution. Journal of Financial Economics, 15(1-2), 61-89.

Berger, A. N., Espinosa Vega, M. A., Frame, W. S., & Miller, N. H. (2005). Debt maturity, risk, and asymmetric information. Journal of Finance, 60, 2895-2923.

Bharath, S. T., Pasquariello, P., & Wu, G. (2009). Does asymmetric information drive capital structure decisions? Review of Financial Studies, 22, 3211.

Boot, A. W. A., Milbourn, T. T., & Schmeits, A. (2006). Credit ratings as coordination mechanisms. Review of Financial Studies, 19, 81.

Bradley, M., Jarrell, G. A., & Kim, E. H. (1984). On the existence of an optimal capital structure: Theory and evidence. Journal of Finance, 39, 857-878.

Brick, I. E., & Ravid, S. A. (1985). On the relevance of debt maturity structure. Journal of Finance, 40, 1423-1437.

Chung, K. H. (2000). Marketing of stocks by brokerage firms: the role of financial analysts. Financial Management, 35-54.

Crabbe, L., & Post, M. A. (1994). The effect of a rating downgrade on outstanding commercial paper. Journal of Finance, 39-56.

Cramer, J. S. (2005). Omitted variables and misspecified disturbances in the logit model (No. 05-084/4). Tinbergen Institute Discussion Paper.

DeAngelo, H., & Masulis, R. W. (1980). Optimal capital structure under corporate and personal taxation. Journal of Financial Economics, 8, 3-29.

Dittmar, A., & Thakor, A. (2007). Why do firms issue equity? Journal of Finance, 62, 1-54.

Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. Review of Financial Studies, 15, 1-33.

Fama, E. F., & French, K. R. (2005). Financing decisions: who issues stock? Journal of Financial Economics, 76, 549-582.

Fischer, E. O., Heinkel, R., & Zechner, J. (1989). Dynamic capital structure choice: Theory and tests. Journal of Finance, 44, 19-40.

Flannery, M. J. (1986). Asymmetric information and risky debt maturity choice. Journal of Finance, 41, 19-37.

Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. Journal of Financial Economics, 67, 217-248.

Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: evidence from the field. Journal of Financial Economics, 60, 187-243.

Hand, J. R. M., Holthausen, R. W., & Leftwich, R. W. (1992). The effect of bond rating agency announcements on bond and stock prices. Journal of Finance, 47, 733-752.

Holthausen, R.W. & Leftwich R.W. (1986). The effect of bond rating changes on common stock prices, Journal of Financial Economics 17, 57–89.

Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. The American Economic Review, 76, 323-329.

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3, 305-360.

King, G., and Zeng, L. (2001). Logistic Regression in Rare Events Data. Political Analysis 9: 137–163.

Kim, C. S., Mauer, D. C., & Sherman, A. E. (1998). The determinants of corporate liquidity: Theory and evidence. Journal of Financial and Quantitative Analysis, 33, 335-359.

Kisgen, D. J. (2006). Credit ratings and capital structure. Journal of Finance, 61, 1035-1072.

Kisgen, D. J. (2009). Do firms target credit ratings or leverage levels? Journal of Financial and Quantitative Analysis, 44, 1323-1344.

Kliger, D., & Sarig, O. (2000). The information value of bond ratings. Journal of Finance, 55, 2879-2902.

Korteweg, A. G. (2010). The net benefits to leverage. Journal of Finance, 65, 2137–2170.

Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. Journal of Finance, 28, 911-922.

Leland, H. E. (1994). Corporate debt value, bond covenants, and optimal capital structure. Journal of Finance, 1213-1252.

Marsh, P. (1982). The choice between equity and debt: An empirical study. Journal of Finance, 37, 121-144.

Myers, S. C. (1977). Determinants of corporate borrowing. Journal of Financial Economics, 5, 147-175.

Myers, S. C. (1984). The capital structure puzzle. Journal of Finance, 39, 575-592.

Myers, S. C. (2001). Capital structure. Journal of Economic Perspectives, 15, 81-102.

Myers, S. C. and Majluf, N.S. (1984), Corporate financing and investment decisions when firms have information that investors do not have, Journal of Financial Economics, 13, 87–221.

Narayanan, M. P. (1988). Debt versus equity under asymmetric information. Journal of Financial and Quantitative Analysis, 23, 39-51.

Nayar, N., & Rozeff, M. S. (1994). Ratings, commercial paper, and equity returns. Journal of Finance, 49, 1431-1449.

Noe, T. H. (1988). Capital structure and signaling game equilibria. Review of Financial Studies, 1, 331-355.

Noe, T. H., & Rebello, M. J. (1996). Asymmetric information, managerial opportunism, financing, and payout policies. Journal of Finance, 51, 637-660.

Peterson, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. Review of Financial Studies, 22, 435-480.

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. Journal of Finance, 50, 1421-1460.

Rauh, J. D., & Sufi, A. (2010). Capital structure and debt structure. Review of Financial Studies, 23, 4242.

Ross, S. A. (1977). The determination of financial structure: the incentive-signalling approach. The Bell Journal of Economics, 8, 23-40.

Scott Jr, J. H. (1976). A theory of optimal capital structure. The Bell Journal of Economics, 7, 33-54.

Tang, T. T. (2009). Information asymmetry and firms' credit market access: Evidence from Moody's credit rating format refinement. Journal of Financial Economics, 93, 325-351.

Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. Journal of Finance, 43, 1-19.

Appendix:

6.1. Firm action variables

In our analysis we examine the effects on changes in *debt*, *equity* and *net debt* for firm i in quarter t defined as follows:

$\triangle det_{i,t} = \frac{\Delta D_{i,t}}{A_{i,t-1}}$: *debt* change, where $\Delta D_{i,t}$ is long-term debt increase (Compustat DLTISY)[13] minus long-term debt reduction (Compustat DLTRY) plus the change in current debt (Compustat DLCCHY) for firm i in quarter t, and $A_{i,t-1}$ is total asset (Compustat ATQ) of firm i in quarter $t-1$.

$\triangle eqt_{i,t} = \frac{\Delta E_{i,t}}{A_{i,t-1}}$: *equity* change, where $\Delta E_{i,t}$ is the sale of common and preferred stock (Compustat SSTKY) minus purchases of common and preferred stock (Compustat PRSTKCY) for firm i in quarter t.

We also analyze *net debt* change (as in Kisgen (2006)) as the difference between $\Delta det_{i,t}$ and $\Delta eqt_{i,t}$, defined as $\Delta net_{i,t} = \frac{\Delta D_{i,t} - \Delta E_{i,t}}{A_{i,t-1}}$.

We further look into details of *debt* changes by examining the effects on short term and long-term debt, respectively.

$\triangle Sdet_{i,t} = \frac{\triangle SD_{i,t}}{A_{i,t-1}}$, where $\triangle SD_{i,t}$ is the change in current debt (Compustat DLCCHY) for firm i in quarter t.

[13] The last letter 'Y' in DLTISY indicates that the variable is year-to-date. We derive quarterly values of observations for all variables using the year-to-date data.

$\triangle Ldet_{i,t} = \frac{\triangle LD_{i,t}}{A_{i,t-1}}$, where $\triangle LD_{i,t}$ is the long-term debt increase (Compustat DLTISY) minus long-term debt reduction (Compustat DLTRY) for firm i in quarter t.

6.2. State variables

We include the control variables ($\mathbf{X}_{i,t}$) which are conventionally considered in capital structure studies including: *Leverage, Size, Price, Liquidity, Profit, Earnings, Growth, Tangibility* and *Non-Debt Tax Shields (NDTS)* to separate their influences from the role of information gap on firms' financing activities.[14]

$Leverage_{i,t}$: the ratio of the sum of short-term debt (*Sdet*) (Compustat DLCQ) and long-term debt (*Ldet*) (Compustat DLTTQ) to the sum of short-term debt, long-term debt and stockholders' equity (Compust LSEQ minus LTQ) for firm i in quarter t.

$Size_{i,t}$: the logarithm of sales (Compustat SALEQ) for firm i in quarter t.

$Price_{i,t}$**:** the logarithm of the stock's quarterly closing price in the quarter (Compustat PRCCQ) for firm i in quarter t.

$Liquidity_{i,t}$: the ratio of cash and cash equivalent (Compustat CHEQ) to total assets (Compustat ATQ) for firm i in quarter t.

$Profit_{i,t}$**:** the ratio of EBITDA to total assets (Compustat ATQ) for firm

[14] Kisgen (2006) shows significant negative relations between leverage and debt financing. Titman and Wessels (1988) show that firm size, as indicated by the logarithm of sales, is one of the crucial determinants of capital structure. Marsh (1982) shows that changes in security prices alter debt/equity ratios. Myers (2001) and Fama and French (2002) demonstrate that profit is an important factor that affects capital structure. Market-to-book ratio (defined as growth in our study) and tangibility are variables affecting leverage ratio in Rajan and Zingales (1995). Dividends and earnings policies relate tightly to the increase of debt and equity sale (Titman and Wessels, 1988). We include liquidity (see Kim, Mauer and Sherman, 1998) to control for possible impacts on leverage from firms' cash positions and non-debt tax shields (DeAngelo and Masulis, 1980, and Bradley, Jarrell and Kim, 1984).

i in quarter t.[15]

$Earnings_{i,t}$**:** the ratio of retained earnings (Compustat REQ) to total assets (Compustat ATQ) for firm i in quarter t.

$Growth_{i,t}$**:** the ratio of total book value of debt plus quarterly close price (Compustat PRCCQ) times the number of common stock shares outstanding (Compustat CSHOQ) to total asset (Compustat ATQ) for firm i in quarter t.

$Tangibility_{i,t}$**:** the ratio of (net) property plant and equipment (Compustat PPENTQ) to total asset (Compustat ATQ) for firm i in quarter t.

$NDTS_{i,t}$**:** the ratio of deferred taxes and investment tax credit (Compustat TXDITCQ) to total assets (Compustat ATQ) for firm i in quarter t.

6.3. Forecasting rating changes

We estimate a logit model by regressing two distinct categories: downgrades and 'others' (no rating change or upgrades) of S&P Long Term Rating ('others' is the reference category) on independent variables as re-written below:

$$LTD^{D}_{i,t+1} = I^{D}(\mathbf{X}_{i,t}) \tag{12}$$

$$LTD^{D}_{i,t+1} = \begin{cases} 1, & SPLT_{i,t+1} < SPLT_{i,t} \\ 0, & SPLT_{i,t+1} \geq SPLT_{i,t} \end{cases}$$

$t = 1, 2, \ldots, 47$, where $LTD^{D}_{i,t+1}$ is the response variable that indicates the rating change choice made by the rating agency. The state variables are conventionally considered in capital structure studies including: *Leverage, Size, Price, Liquidity, Profit, Earnings, Growth, Tangibility* and *non-debt tax shields (NDTS)* (see also, Ederington and Yawitz, 1986), including firm

[15] $EBITDA_{i,t}$ is the earnings before interest, tax, depreciation and amortization for firm i at time t, which is calculated as the sum of pretax income (Compustat PIQ), interest expense (Compustat TIEQ) and depreciation and amortization (Compustat DPQ).

action variables: $\triangle det_{i,t}$ and $\triangle eqt_{i,t}$.

The predicted rating downgrade probability $\widehat{LTD}^{D}_{i,t+1}$ for firm i in quarter $t+1$ is given by:

$$\widehat{LTD}^{D}_{i,t+1} = Prob\left(LTD^{D}_{i,t+1} = 1\right) = \frac{exp(\mathbf{X}'_{i,t}\widehat{\beta})}{1 + exp(\mathbf{X}'_{i,t}\widehat{\beta})} \tag{13}$$

The standard interpretation of the logit model is that for a one unit change in the predictor variables, the outcome relative to the reference group is expected to change by its respective parameter estimation given that other variables in the model are unchanged.

The estimation of (12) shows that the probability of downgrade $\widehat{LTD}^{D}_{i,t+1}$ is decreasing with profitability. The p-values from goodness of fit test shows that the model is a good fit for the data overall.

For long-term credit ratings, 1.17% of the observations are downgrades. Thus, downgrades are rare events, and the predictors could suffer from small sample bias. Therefore we use the King and Zeng (2001) rare events small sample correction method for a binomial logistic model. This improves the predictability of the probabilities.